

## EXERCISES FOR SECTION 1.3

In Exercises 1–4, use a graphing utility to graph the function and visually estimate the limits.

1.  $h(x) = x^2 - 5x$ 
  - (a)  $\lim_{x \rightarrow 5} h(x)$
  - (b)  $\lim_{x \rightarrow -1} h(x)$
2.  $g(x) = \frac{12(\sqrt{x} - 3)}{x - 9}$ 
  - (a)  $\lim_{x \rightarrow 4} g(x)$
  - (b)  $\lim_{x \rightarrow 0} g(x)$
3.  $f(x) = x \cos x$ 
  - (a)  $\lim_{x \rightarrow 0} f(x)$
  - (b)  $\lim_{x \rightarrow \pi/3} f(x)$
4.  $f(t) = t|t - 4|$ 
  - (a)  $\lim_{t \rightarrow 4} f(t)$
  - (b)  $\lim_{t \rightarrow -1} f(t)$

In Exercises 5–22, find the limit.

5.  $\lim_{x \rightarrow 2} x^4$
6.  $\lim_{x \rightarrow -2} x^3$
7.  $\lim_{x \rightarrow 0} (2x - 1)$
8.  $\lim_{x \rightarrow -3} (3x + 2)$
9.  $\lim_{x \rightarrow -3} (x^2 + 3x)$
10.  $\lim_{x \rightarrow 1} (-x^2 + 1)$
11.  $\lim_{x \rightarrow -3} (2x^2 + 4x + 1)$
12.  $\lim_{x \rightarrow -1} (3x^3 - 2x^2 + 4)$
13.  $\lim_{x \rightarrow 2} \frac{1}{x}$
14.  $\lim_{x \rightarrow -3} \frac{2}{x + 2}$
15.  $\lim_{x \rightarrow 1} \frac{x - 3}{x^2 + 4}$
16.  $\lim_{x \rightarrow 3} \frac{2x - 3}{x + 5}$
17.  $\lim_{x \rightarrow 7} \frac{5x}{\sqrt{x} + 2}$
18.  $\lim_{x \rightarrow 3} \frac{\sqrt{x} + 1}{x - 4}$
19.  $\lim_{x \rightarrow 3} \sqrt{x + 1}$
20.  $\lim_{x \rightarrow 4} \sqrt[3]{x + 4}$
21.  $\lim_{x \rightarrow -4} (x + 3)^2$
22.  $\lim_{x \rightarrow 0} (2x - 1)^3$

In Exercises 23–26, find the limits.

23.  $f(x) = 5 - x$ ,  $g(x) = x^3$ 
  - (a)  $\lim_{x \rightarrow 1} f(x)$
  - (b)  $\lim_{x \rightarrow 4} g(x)$
  - (c)  $\lim_{x \rightarrow 1} g(f(x))$
24.  $f(x) = x + 7$ ,  $g(x) = x^2$ 
  - (a)  $\lim_{x \rightarrow -3} f(x)$
  - (b)  $\lim_{x \rightarrow 4} g(x)$
  - (c)  $\lim_{x \rightarrow -3} g(f(x))$
25.  $f(x) = 4 - x^2$ ,  $g(x) = \sqrt{x + 1}$ 
  - (a)  $\lim_{x \rightarrow 1} f(x)$
  - (b)  $\lim_{x \rightarrow 3} g(x)$
  - (c)  $\lim_{x \rightarrow 1} g(f(x))$
26.  $f(x) = 2x^2 - 3x + 1$ ,  $g(x) = \sqrt[3]{x + 6}$ 
  - (a)  $\lim_{x \rightarrow 4} f(x)$
  - (b)  $\lim_{x \rightarrow 21} g(x)$
  - (c)  $\lim_{x \rightarrow 4} g(f(x))$

In Exercises 27–36, find the limit of the trigonometric function.

27.  $\lim_{x \rightarrow \pi/2} \sin x$
28.  $\lim_{x \rightarrow \pi} \tan x$
29.  $\lim_{x \rightarrow 2} \cos \frac{\pi x}{3}$
30.  $\lim_{x \rightarrow 1} \sin \frac{\pi x}{2}$
31.  $\lim_{x \rightarrow 0} \sec 2x$
32.  $\lim_{x \rightarrow \pi} \cos 3x$
33.  $\lim_{x \rightarrow 5\pi/6} \sin x$
34.  $\lim_{x \rightarrow 5\pi/3} \cos x$

$$35. \lim_{x \rightarrow 3} \tan\left(\frac{\pi x}{4}\right)$$

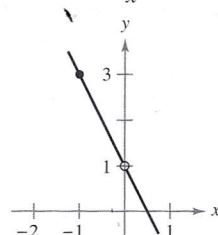
$$36. \lim_{x \rightarrow 7} \sec\left(\frac{\pi x}{6}\right)$$

In Exercises 37–40, use the information to evaluate the limits.

37.  $\lim_{x \rightarrow c} f(x) = 2$   
 $\lim_{x \rightarrow c} g(x) = 3$ 
  - (a)  $\lim_{x \rightarrow c} [5g(x)]$
  - (b)  $\lim_{x \rightarrow c} [f(x) + g(x)]$
  - (c)  $\lim_{x \rightarrow c} [f(x)g(x)]$
  - (d)  $\lim_{x \rightarrow c} \frac{f(x)}{g(x)}$
38.  $\lim_{x \rightarrow c} f(x) = \frac{3}{2}$   
 $\lim_{x \rightarrow c} g(x) = \frac{1}{2}$ 
  - (a)  $\lim_{x \rightarrow c} [4f(x)]$
  - (b)  $\lim_{x \rightarrow c} [f(x) + g(x)]$
  - (c)  $\lim_{x \rightarrow c} [f(x)g(x)]$
  - (d)  $\lim_{x \rightarrow c} \frac{f(x)}{g(x)}$
39.  $\lim_{x \rightarrow c} f(x) = 4$ 
  - (a)  $\lim_{x \rightarrow c} [f(x)]^3$
  - (b)  $\lim_{x \rightarrow c} \sqrt{f(x)}$
  - (c)  $\lim_{x \rightarrow c} [3f(x)]$
  - (d)  $\lim_{x \rightarrow c} [f(x)]^{3/2}$
40.  $\lim_{x \rightarrow c} f(x) = 27$ 
  - (a)  $\lim_{x \rightarrow c} \sqrt[3]{f(x)}$
  - (b)  $\lim_{x \rightarrow c} \frac{f(x)}{18}$
  - (c)  $\lim_{x \rightarrow c} [f(x)]^2$
  - (d)  $\lim_{x \rightarrow c} [f(x)]^{2/3}$

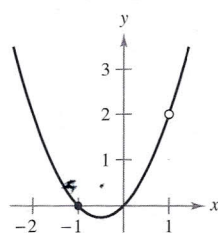
In Exercises 41–44, use the graph to determine the limit visually (if it exists). Write a simpler function that agrees with the given function at all but one point.

$$41. g(x) = \frac{-2x^2 + x}{x}$$



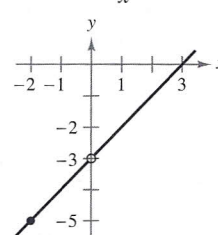
- (a)  $\lim_{x \rightarrow 0} g(x)$
- (b)  $\lim_{x \rightarrow -1} g(x)$

$$43. g(x) = \frac{x^3 - x}{x - 1}$$



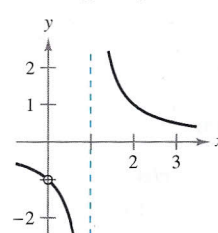
- (a)  $\lim_{x \rightarrow 1} g(x)$
- (b)  $\lim_{x \rightarrow -1} g(x)$

$$42. h(x) = \frac{x^2 - 3x}{x}$$



- (a)  $\lim_{x \rightarrow -2} h(x)$
- (b)  $\lim_{x \rightarrow 0} h(x)$

$$44. f(x) = \frac{x}{x^2 - x}$$



- (a)  $\lim_{x \rightarrow 1} f(x)$
- (b)  $\lim_{x \rightarrow 0} f(x)$